Claims

1. A linear accelerometer comprising:

a substrate;

a fixed electrode supported on the substrate and including a first plurality of fixed capacitive plates;

an inertial mass substantially suspended over a cavity and including a plurality of movable capacitive plates arranged to provide a capacitive coupling with said first plurality of fixed capacitive plates, said inertial mass being linearly movable relative to said fixed electrode;

a central member fixed to said substrate and located substantially in a central region of said inertial mass;

a plurality of support arms for supporting the inertial mass relative to the fixed electrode and allowing linear movement of the inertial mass upon experiencing a linear acceleration along a sensing axis, and for preventing movement along a nonsensing axis;

an input electrically coupled to one of either the fixed electrode and the inertial mass for receiving an input signal; and

an output electrically coupled to the other of the fixed electrode and the inertial mass for providing an output signal which varies as a function of the capacitive coupling and is indicative of linear acceleration along the sensing axis.

2. The linear accelerometer as defined in claim 1, wherein the inertial mass has a substantially annular ring shape.

3. The linear accelerometer as defined in claim 2, wherein the inertial mass has an elliptical shaped ring.

4. The linear accelerometer as defined in claim 1, wherein said inertial mass is substantially centrally located, and said first fixed electrode is radially displaced from said inertial mass.

5. The linear accelerometer as defined in claim 1, wherein the plurality of support arms extend perpendicular to the sensing axis.

6. The linear accelerometer as defined in claim 5, wherein said plurality of support arms extend between the inertial mass and a rigid member fixedly coupled to the central member.

7. The linear accelerometer as defined in claim 1, wherein said plurality of support arms comprises at least four tethers.

8. The linear accelerometer as defined in claim 1, wherein each of said plurality of support arms are flexible so as to bend during linear acceleration about the sensed axis, yet rigid to resist bending due to linear accelerations about the non-sensing axis.

9. The linear accelerometer as defined in claim 1, wherein said substrate comprises a silicon substrate.

10. The linear accelerometer as defined in claim 1, wherein said linear accelerometer is fabricated by a trench etching process.

11. A linear accelerometer comprising:

a substrate;

a first bank of variable capacitors formed on a first plurality of fixed capacitive plates and a first plurality of movable capacitive plates;

a second bank of variable capacitors formed on a second plurality of fixed capacitive plates and a second plurality of movable capacitive plates;

an inertial mass that is linearly movable in response to linear acceleration along a sensing axis, wherein the inertial mass is electrically

coupled to said first and second plurality of movable capacitive plates and is arranged so that said first and second movable capacitive plates form capacitive couplings with said first and second plurality of fixed capacitive plates;

a central member fixed to said substrate and centrally located within said inertial mass and separated therefrom;

a plurality of support arms extending between the central mass and the inertial mass for supporting the inertial mass and movable capacitive plates relative to the first and second capacitive plates and allowing linear movement of the inertial mass upon experiencing a linear acceleration along the sensing axis and for preventing linear movement along a nonsensing axis;

a first input electrically coupled to the first plurality of fixed capacitive plates;

a second input electrically coupled to the second plurality of fixed capacitive plates; and

an output electrically coupled to the plurality of movable capacitive plates for sensing an output signal indicative of linear acceleration sensed along the sensing axis in response to linear movement of the inertial mass.

12. The linear accelerometer as defined in claim 11, wherein each of the plurality of support arms comprises a tether having a section extending substantially perpendicular to the sensing axis.

13. The linear accelerometer as defined in claim 12, wherein said tether is connected between the inertial mass and a rigid member coupled to the central member.

14. The linear accelerometer as defined in claim 11, wherein said inertial mass is substantially centrally located, and said first and

second plurality of movable capacitive plates are radially extended from the inertial mass.

15. The linear accelerometer as defined in claim 11, wherein said substrate comprises a silicon substrate.

16. The linear accelerometer as defined in claim 15, wherein said linear accelerometer is fabricated by a trench etching process.

17. The linear accelerometer as defined in claim 11 further comprising:

a third bank of variable capacitors formed of a third plurality of fixed capacitive plates and a third plurality of movable capacitive plates; and

a fourth bank of variable capacitors formed of a fourth plurality of fixed capacitive plates and a fourth plurality of movable capacitive plates.

18. The linear accelerometer as defined in claim 17, wherein said plurality of support arms comprise at least four tethers, one tether for each of the first, second, third, and fourth plurality of movable capacitive plates.

19. The linear accelerometer as defined in claim 11, wherein each of said support arms are flexible so as to bend during linear acceleration about the sensing axis, yet rigid to resist bending due to acceleration along the nonsensing axis.

20. A micromachined linear accelerometer comprising:

a substrate;

a fixed electrode supported on the substrate and including a first plurality of fixed capacitive plates;

a ring having a central opening and including a plurality of movable capacitive plates at the outer perimeter arranged to provide a capacitive coupling with the first plurality of fixed capacitive plates, said ring being suspended over a cavity and linearly movable relative to the fixed electrode;

a central member fixed to the substrate and located within the central opening of the ring;

a plurality of support arms extending between the central member and the ring for supporting said ring relative to said fixed electrode and allowing linear movement of the ring along a sensing axis upon experiencing a linear acceleration along the sensing axis;

an input electrically coupled to one of either the fixed electrodes and the ring for receiving an input signal; and

an output electrically coupled to the other of the fixed electrode and the ring for providing an output signal which varies as a function of the capacitive coupling and is indicative of linear acceleration along the sensing axis.

21. The linear accelerometer as defined in claim 20, wherein each of the plurality of support arms comprises an arm extending between the ring and a rigid member coupled to the central member, and wherein the arm is formed by removing material on opposite sides of the arm.

22. The linear accelerometer as defined in claim 20, wherein each of said plurality of arms extends substantially perpendicular to the sensing axis.